

IN THE CLAIMS

What is claimed is:

1 **1.** A method, comprising:
2 varying a dopant supply rate for a doped insulating layer according to
3 a variation in temperature of a substrate on which the doped insulating layer is
4 being formed.

1 **2.** The method of claim 1, wherein:
2 varying the dopant supply rate includes providing different dopant
3 supply rates for different time periods.

1 **3.** The method of claim 2, wherein:
2 the different time periods include a plurality of time periods of the
3 same length, the dopant supply rate being different during at least two of the
4 time periods.

1 **4.** The method of claim 1, wherein:
2 the doped insulating layer is formed with a high density plasma
3 deposition process.

1 **5.** The method of claim 1, wherein:
2 the doped insulating layer comprises phosphosilicate glass.

1 **6.** The method of claim 1, wherein:

2 varying the dopant supply rate includes increasing the dopant supply
3 rate as the substrate temperature increases.

1 **7.** The method of claim 1, further including:

2 etching a contact hole through the doped insulating layer to the
3 substrate.

1 **8.** The method of claim 7, wherein:

2 the doped insulating layer comprises phosphosilicate glass having a
3 phosphorous dopant concentration of greater than about 6% by weight..

1 **9.** The method of claim 1, further including:

2 varying the dopant supply rate over a first period of time and
3 maintaining a constant dopant supply rate for a second period of time.

1 **10.** The method of claim 9, wherein:

2 the first period of time precedes the second period of time.

1 **11.** A method, comprising:
2 compensating for a temperature dependent dopant gradient in an
3 insulating film by varying a dopant supply rate as the insulating film is
4 formed.

1 **12.** The method of claim 11, wherein:
2 the insulating film comprises silicon oxide having a phosphorous
3 concentration greater than about 7% by weight.

1 **13.** The method of claim 11, wherein:
2 the dopant supply rate is varied for an initial thickness of the insulating
3 film to compensate for variations in a substrate temperature.

1 **14.** The method of claim 13, wherein:
2 the initial thickness is no more than 0.8 microns.

1 **15.** The method of claim 13, wherein:
2 the initial thickness is no more than 0.2 microns.

1 **16.** The method of claim 11, wherein:
2 varying the dopant supply rate includes altering a supply rate ratio
3 given by a dopant source supply rate divided by the dopant source supply rate
4 plus a base material source supply rate.

1 **17.** The method of claim 16, wherein:

2 the dopant source supply rate includes a flow rate for a source of
3 phosphorous, the base material source supply rate includes a flow rate for a
4 source of silicon, and the supply rate ratio varies from about 30% to 45%.

1 **18.** The method of claim 11, further including:

2 varying the dopant supply rate for a first portion of the insulating film
3 and maintaining a constant dopant supply rate for a second portion of the
4 insulating film.

1 **19.** The method of claim 11, wherein:

2 varying the dopant supply rate includes closed loop control of dopant
3 source supply rate with active temperature feedback from a reaction chamber

1 **20.** A semiconductor device, comprising:
2 a doped insulating film formed with a high density plasma on a
3 substrate, the doped insulating film having a dopant concentration greater than
4 about 7% by weight and varying by less than about 1% by weight over an
5 initial thickness of no more than 0.2 microns.

1 **21.** The semiconductor device of claim 20, wherein:
2 the doped insulating film comprises silicon oxide with a phosphorous
3 concentration greater than about 7% by weight and varying by less than about
4 1% by weight.

1 **22.** The semiconductor device of claim 20, wherein:
2 the high density plasma includes dissociated phosphine and silane.